

# ABXT Demonstration Project

## 2011 Summary and Preliminary Results

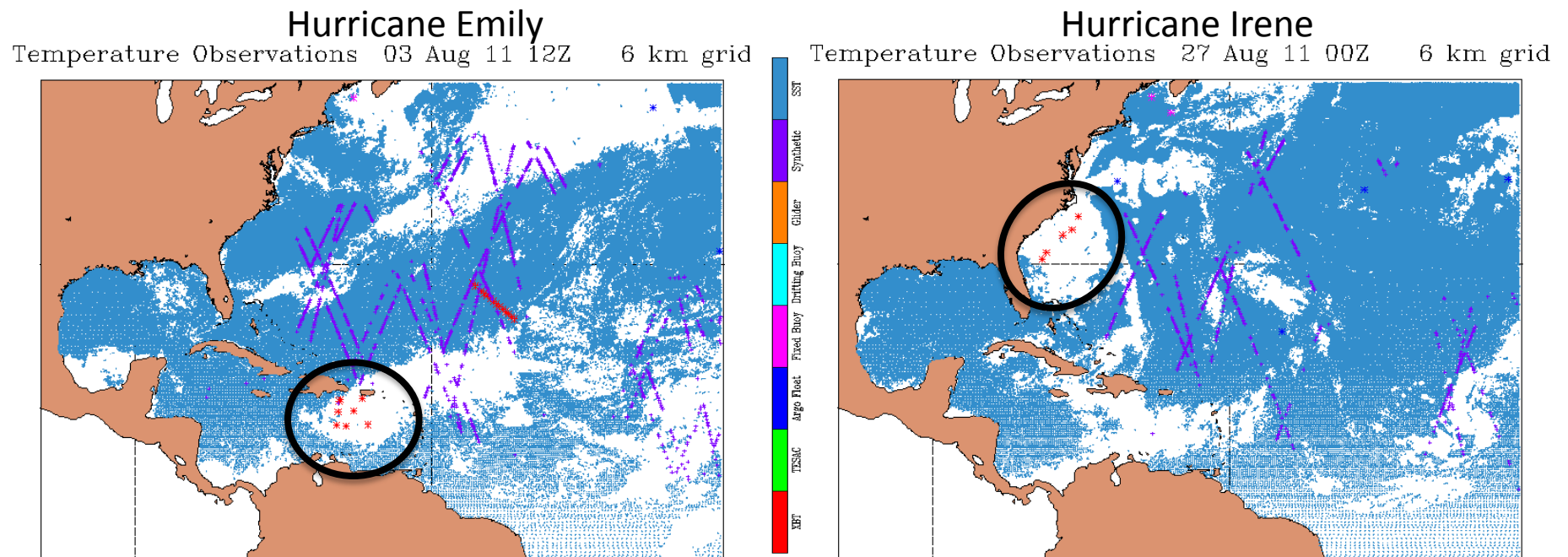
CDR Elizabeth Sanabia, PhD, USN  
United States Naval Academy, Annapolis, MD

Dr. Peter Black  
SAIC and Naval Research Laboratory, Monterey, CA

**2011 NOAA Hurricane Conference**  
29 November 2011

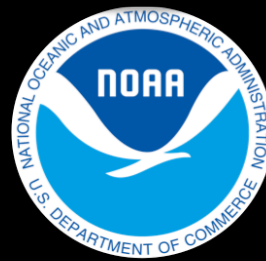
# Background

- The 65<sup>th</sup> Interdepartmental Hurricane Conference working group agenda item added March 2011
- ABXT demonstration project in support of hurricane coupled modeling products and improvement in guidance to NHC hurricane specialists



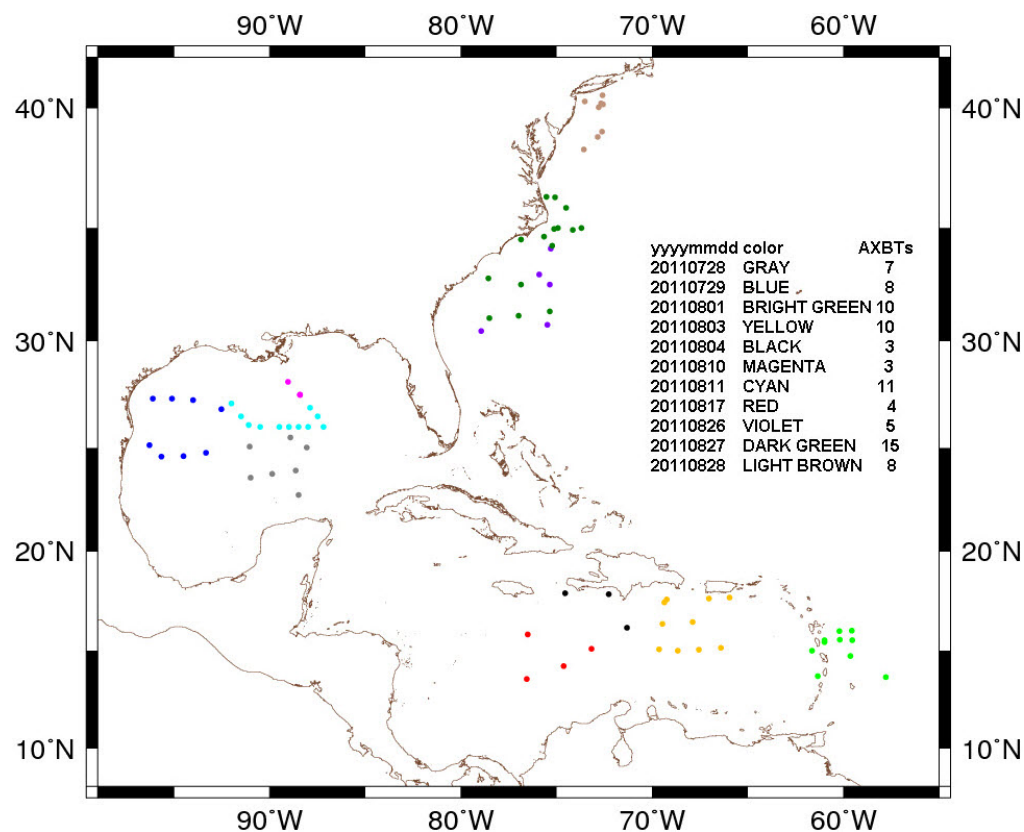
Sea-surface observations in NAVO NCODA (prior to NCOM / HYCOM and COAMPS)

# A Group Effort



## 2011 by the numbers

- **109** AXBTs deployed over **12** missions in **31** days:
  - Hurricane Irene (3 flights)
  - Tropical Storm Don (2 flights)
  - Tropical Storm Emily (3 flights)
  - Pre-TS Harvey (1 flight)
  - 2 training & 1 transit flights
- **85** AXBTs passed the initial QC check at NAVO.
- **8** SOPs developed for data collection, processing, dissemination, and archiving





WC-130J in flight

Deploy → Collect → Process → Transmit

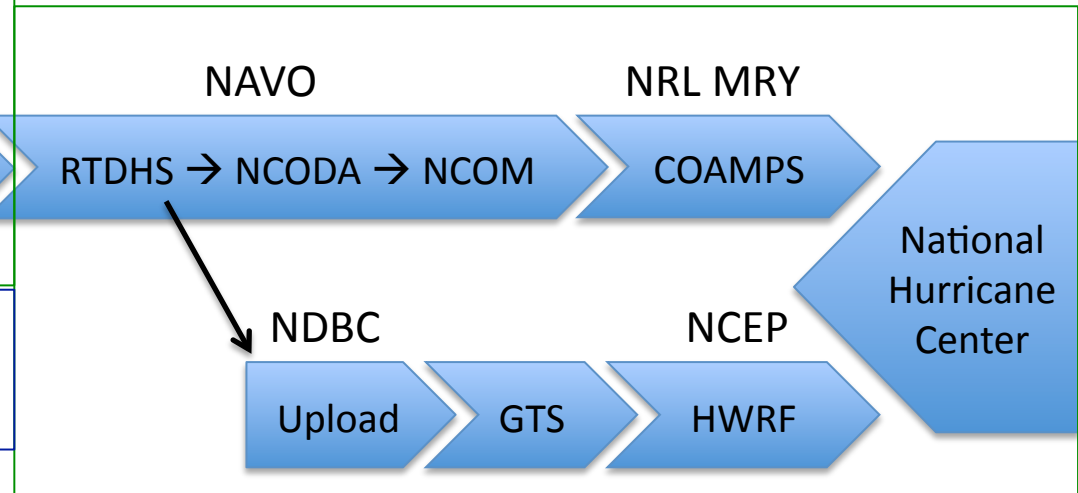


53<sup>rd</sup> SATCOM  
Ground Station

Disseminate

NAVO = Naval Oceanographic Office  
NRL MRY = Naval Research Laboratory Monterey  
NDBC = National Data Buoy Center  
NCEP = National Centers for Environmental Prediction

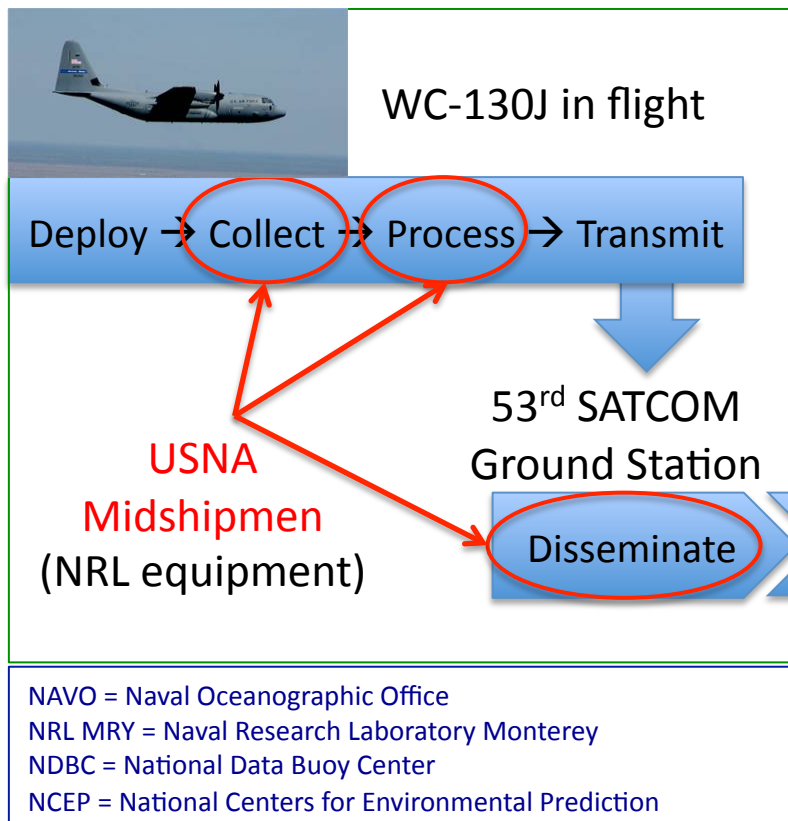
## AXBT Data Path



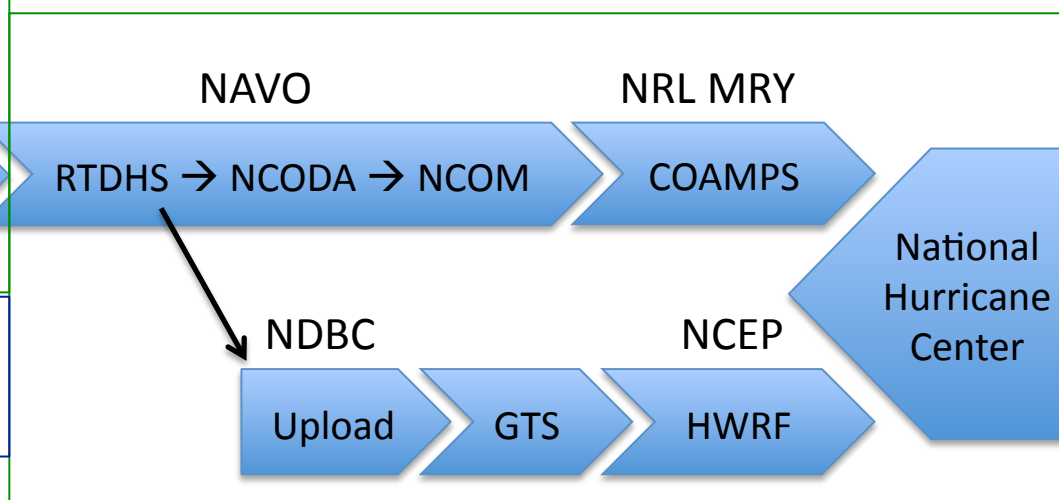
## TROPIC Field Phase

1. **Goal:** Get the ocean data from the aircraft into the coupled models in as near real time as possible.



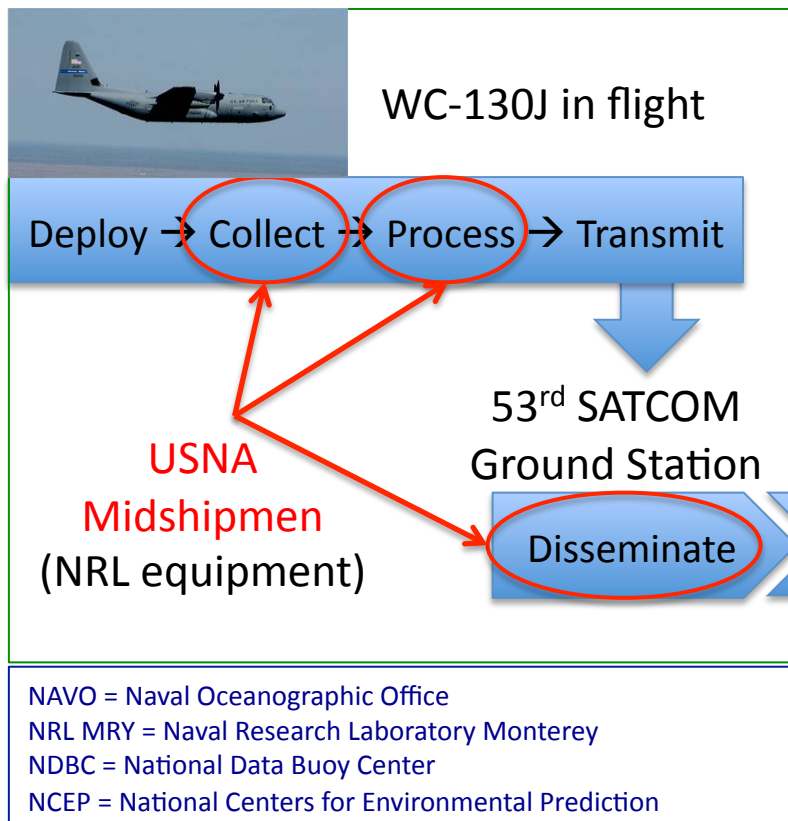


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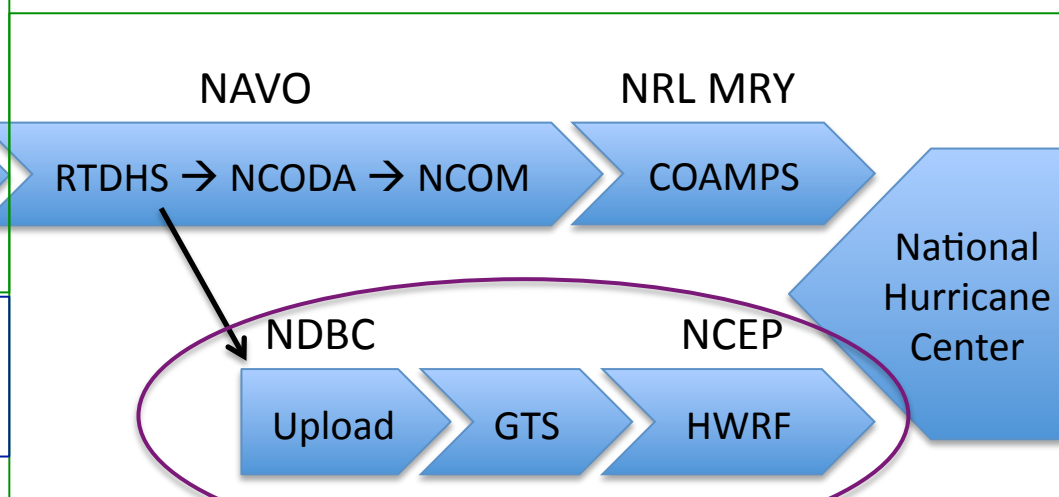


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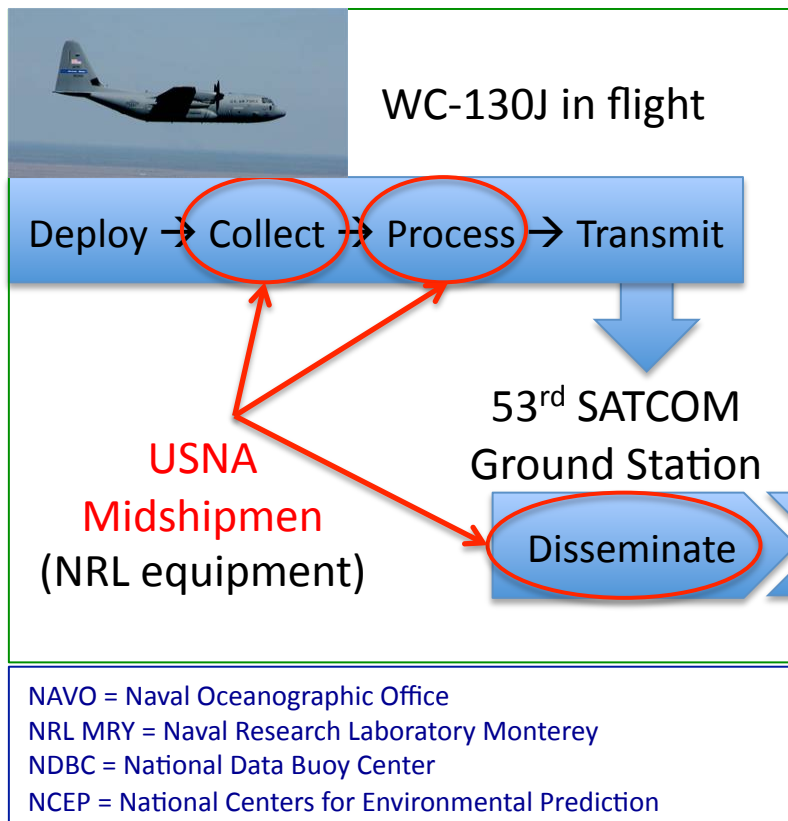
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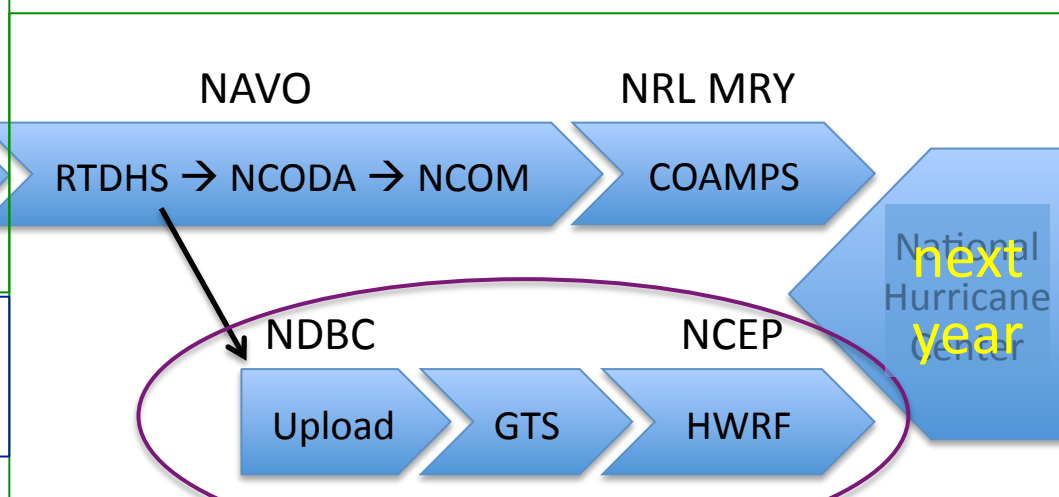
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3. **Coordination:** 53<sup>rd</sup> WRS, CARCAH, NAVO, NDBC, NRL MRY, NCEP

1<sup>st</sup> ever upload of  
ocean observations  
into HWRF



## AXBT Data Path



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WC-130J in flight

Deploy → Collect → Process → Transmit

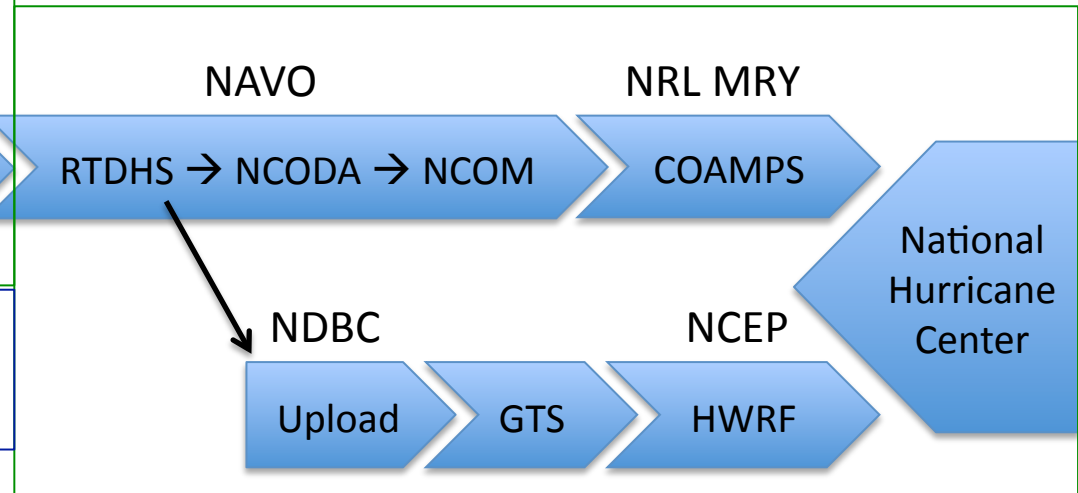


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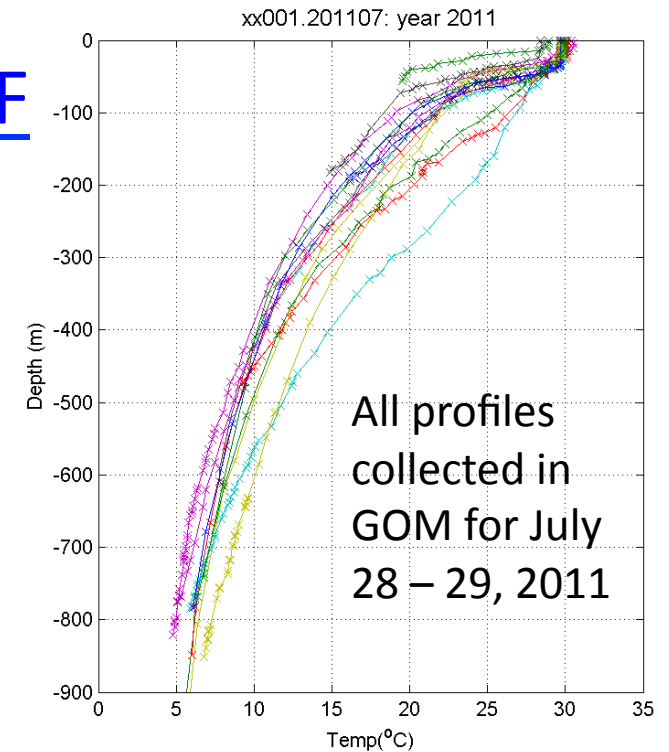
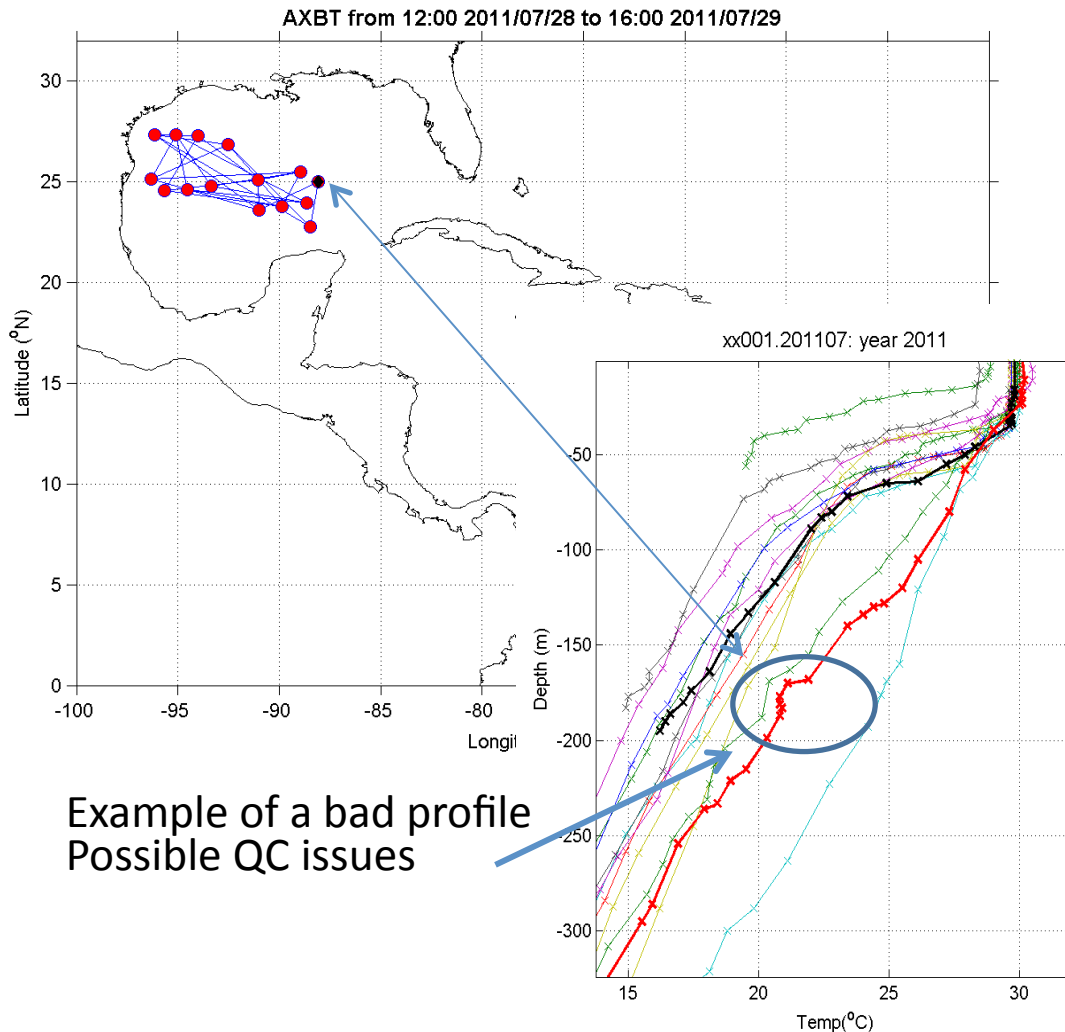


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# Operational Results & Status: HWRF

**July 28 – 29, 2011**



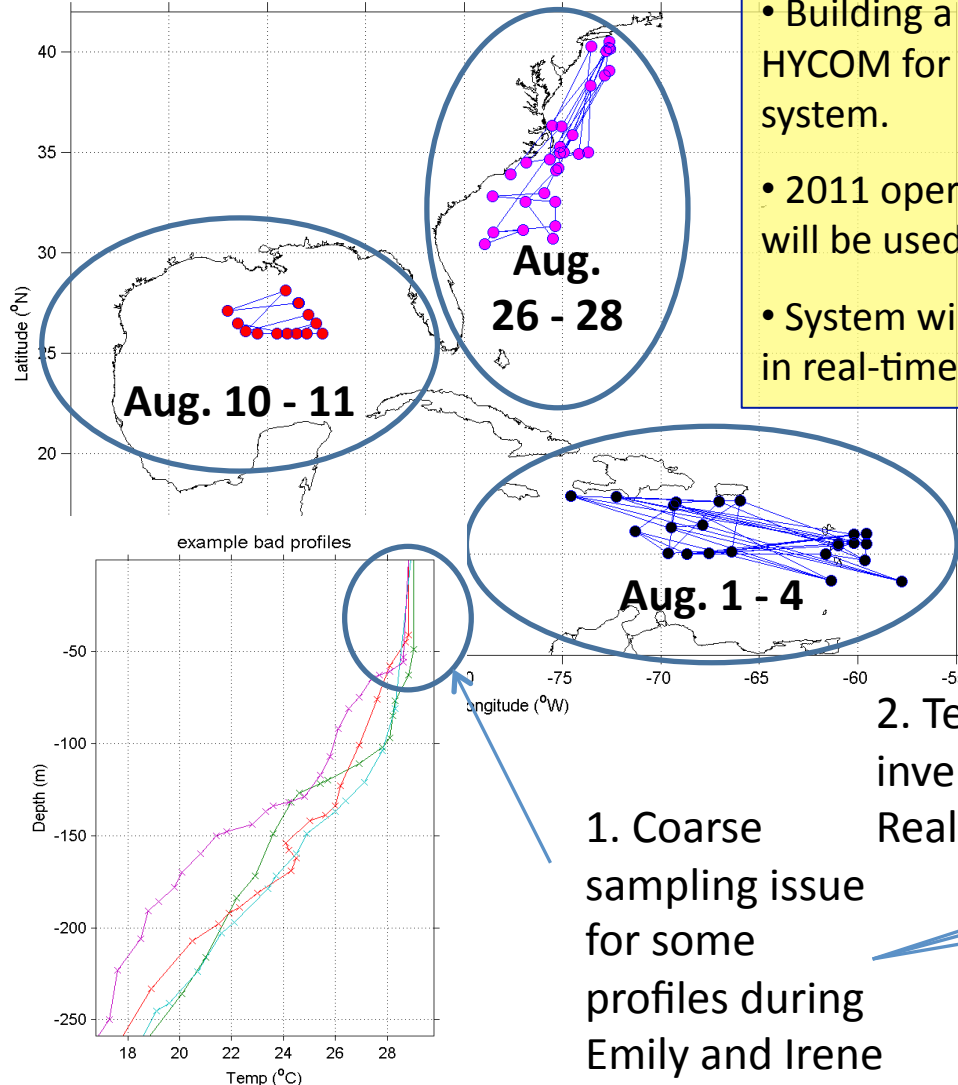
## Data: Timing and Quality

- Most data not received in near real time in 2011.
- Currently able to receive and decode in real time.
- Data quality occasionally questionable.
- Need to improve QC system.

# Operational Results & Status: HWRF

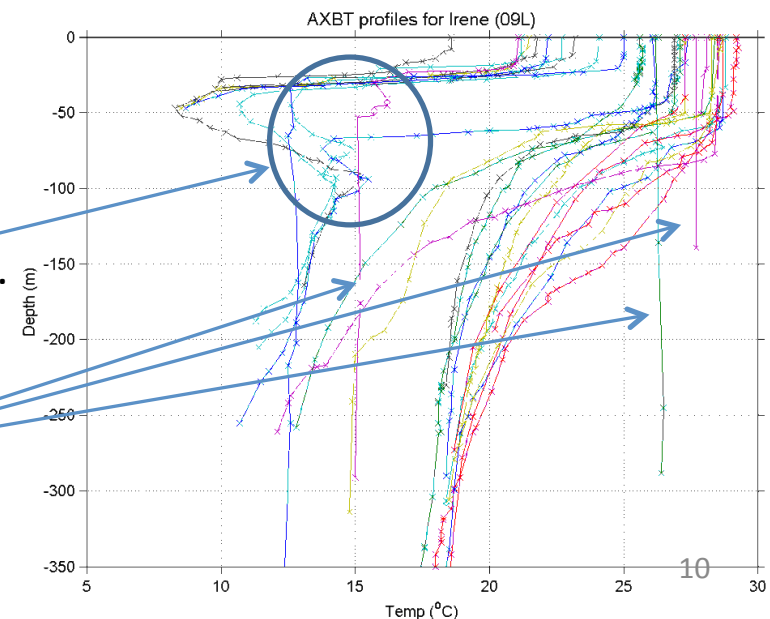
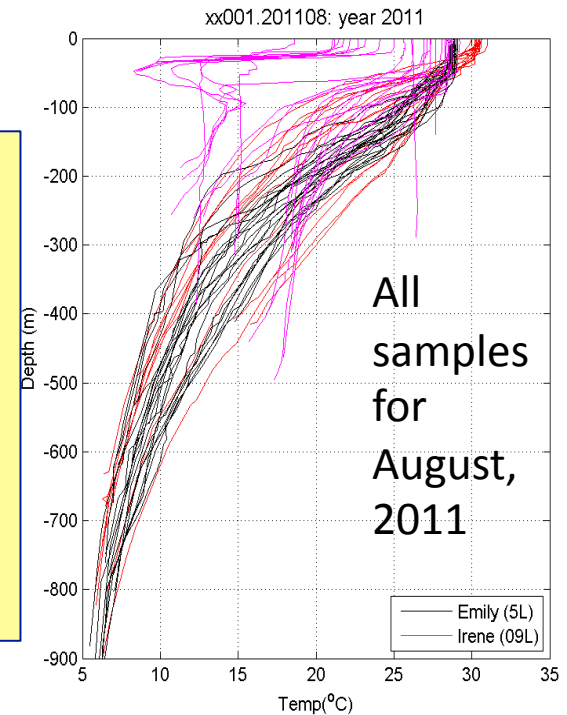
## August 1 – 28, 2011

AXBT from 17:00 2011/08/01 to 12:00 2011/08/28



### Assimilation

- Building a DA framework in HYCOM for the HWRF coupled system.
- 2011 operational AXBT data will be used to test this system.
- System will run in test mode in real-time next season.

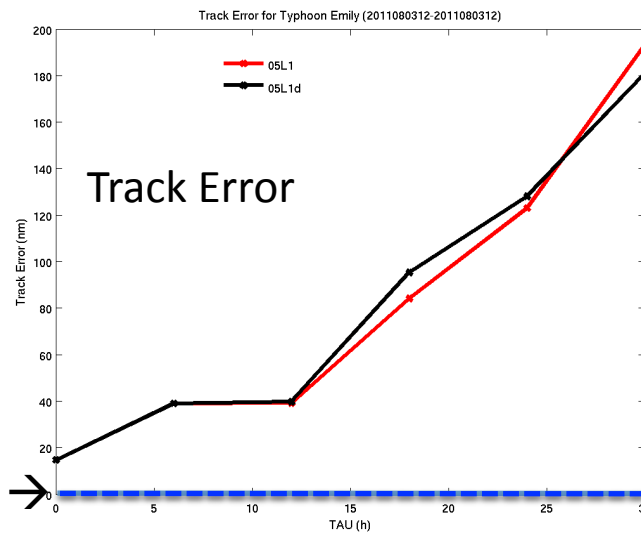
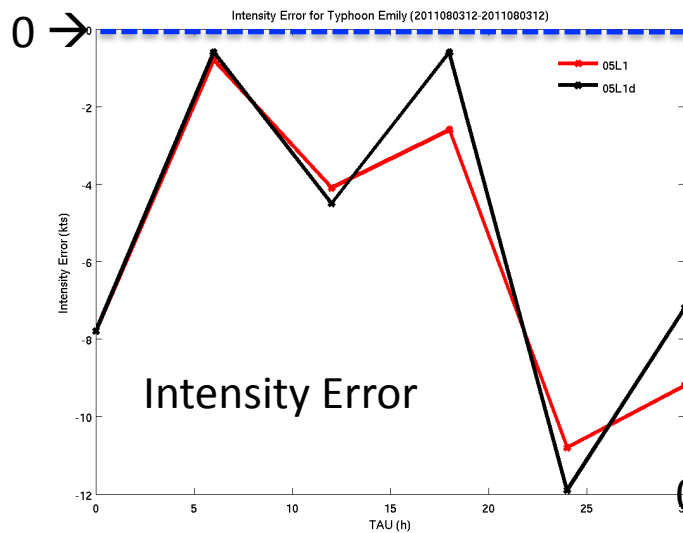


Input from Hyung-Sook Kim, EMC



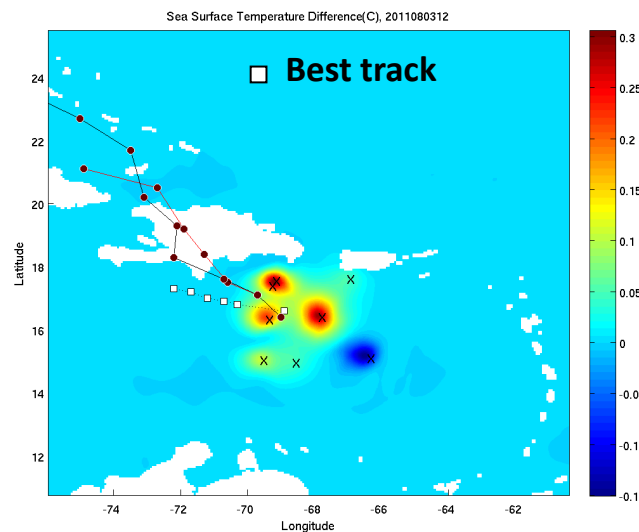
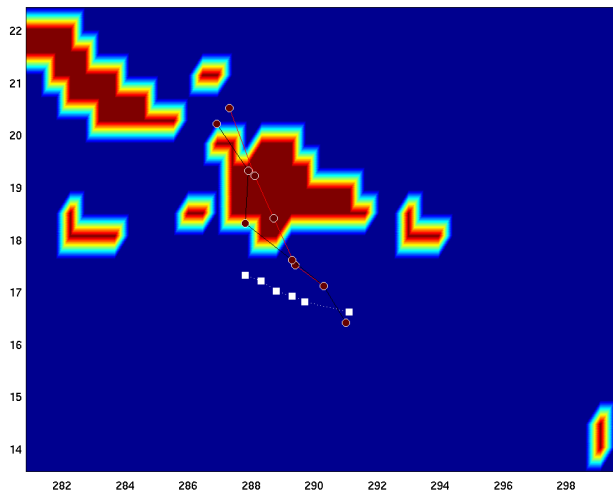


# AXBT Impact Study – Hurricane Emily



Run with  
AXBT

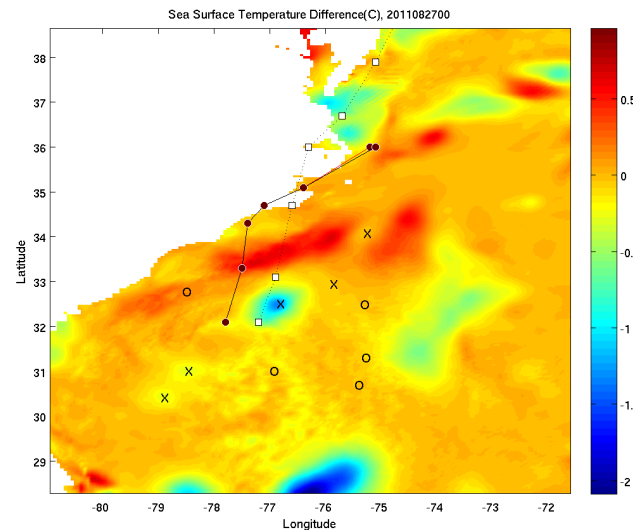
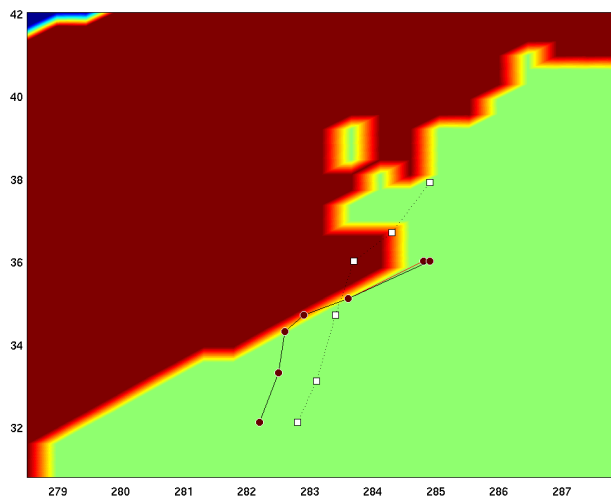
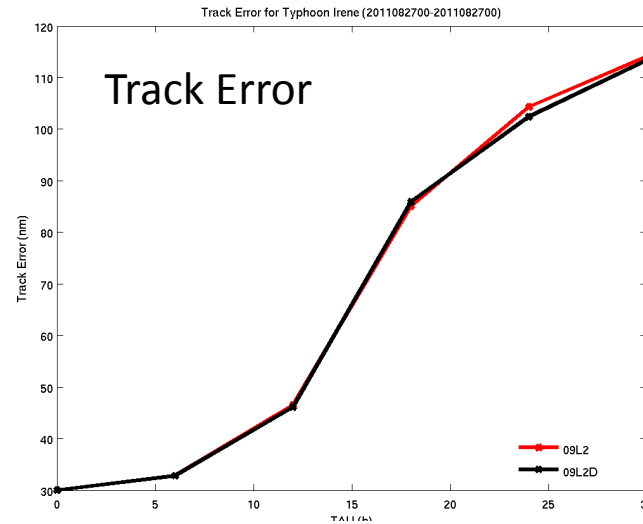
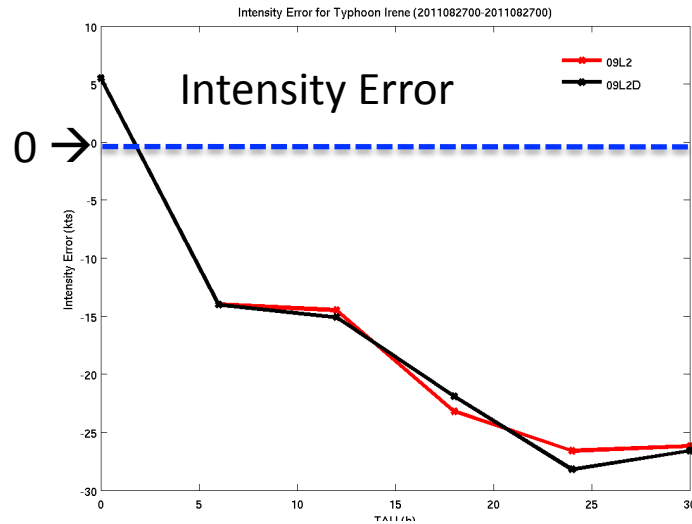
- AXBT assimilation run has a  $0.3^{\circ}\text{C}$  warmer SST than the run without the AXBT
- Slight track difference after 12h



Courtesy: Sue Chen, NRL Monterey



# AXBT Impact Study – Hurricane Irene



2011082700 run

➤ Very little track and intensity difference

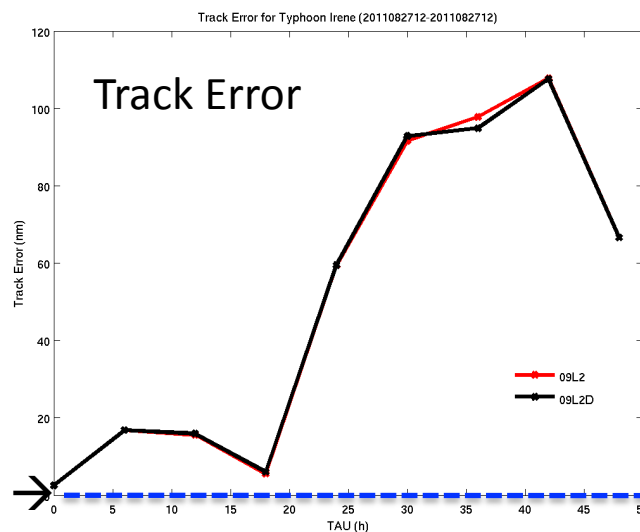
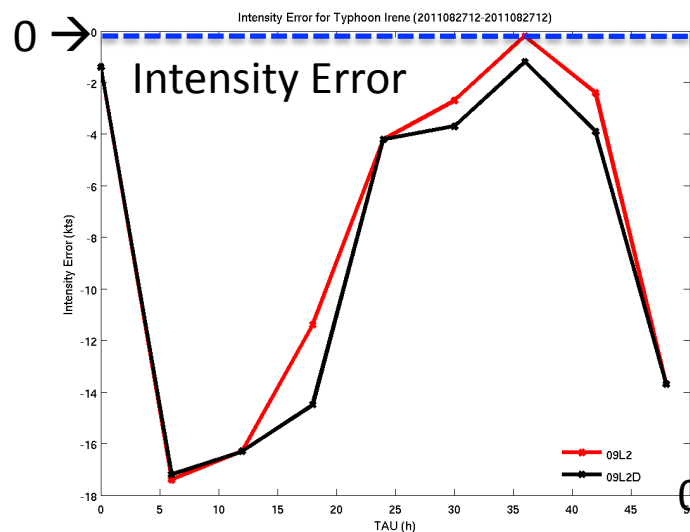
➤ 5 out of 10 AXBTs (Xs) were used in the AXBT data assimilation run

➤ Need to change NCODA profile selection criteria

Courtesy: Sue Chen, NRL Monterey



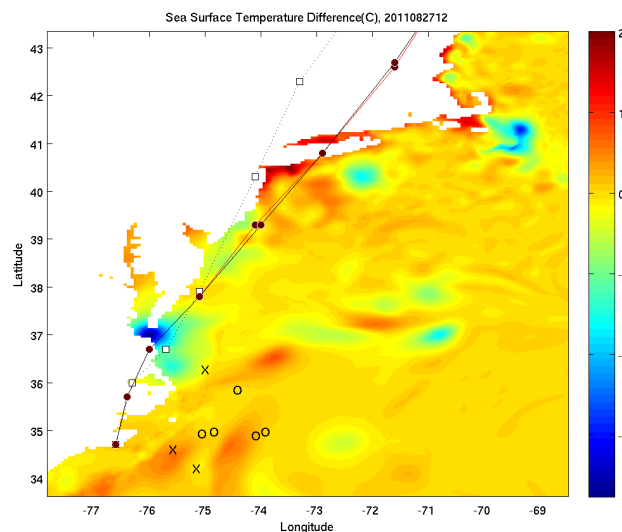
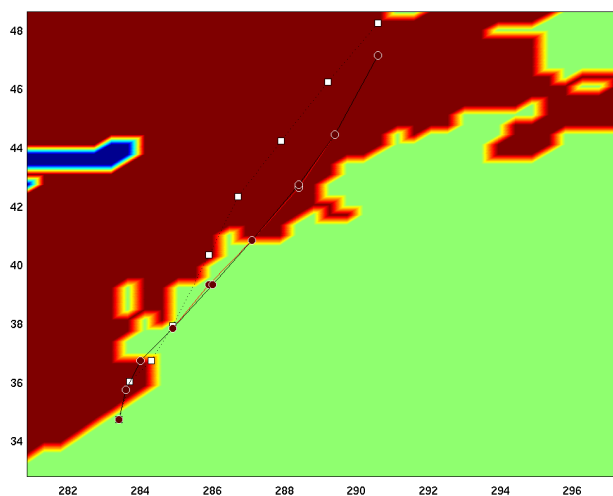
# AXBT Impact Study – Hurricane Irene



2011082712 run

➤ 2 knots  
smaller intensity  
error with the  
AXBT assimilation  
run

➤ No track  
difference



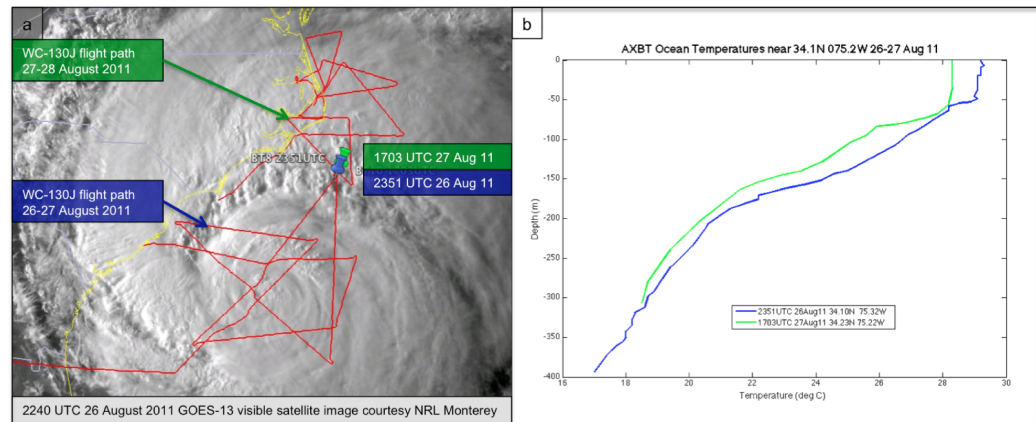
➤ 3 out of 8  
AXBTs (Xs) were  
used in the AXBT  
data  
assimilation run

Courtesy: Sue Chen, NRL Monterey

# Midshipmen Projects

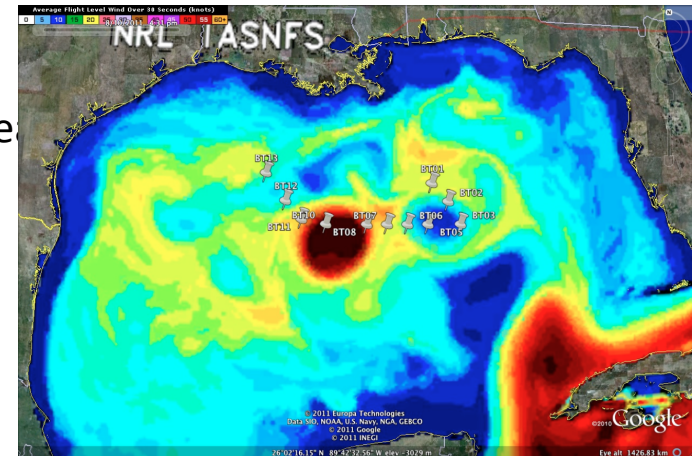
- **Upper ocean heat loss following TC passage**

- Mechanisms
- Comparison to model
- Evaluation of intensity changes for slow-moving systems



- **Model vs. observed ocean heat content**

- Initial results indicate the model underestimates the ocean heat content, and the greater the observed ocean heat content, the greater the error.
- Investigation ongoing with regard to error relative to storm track (greater left or right, ahead or behind)
- Impact of differences on statistical model intensity forecasts.



# Current Operations: Topics and Challenges

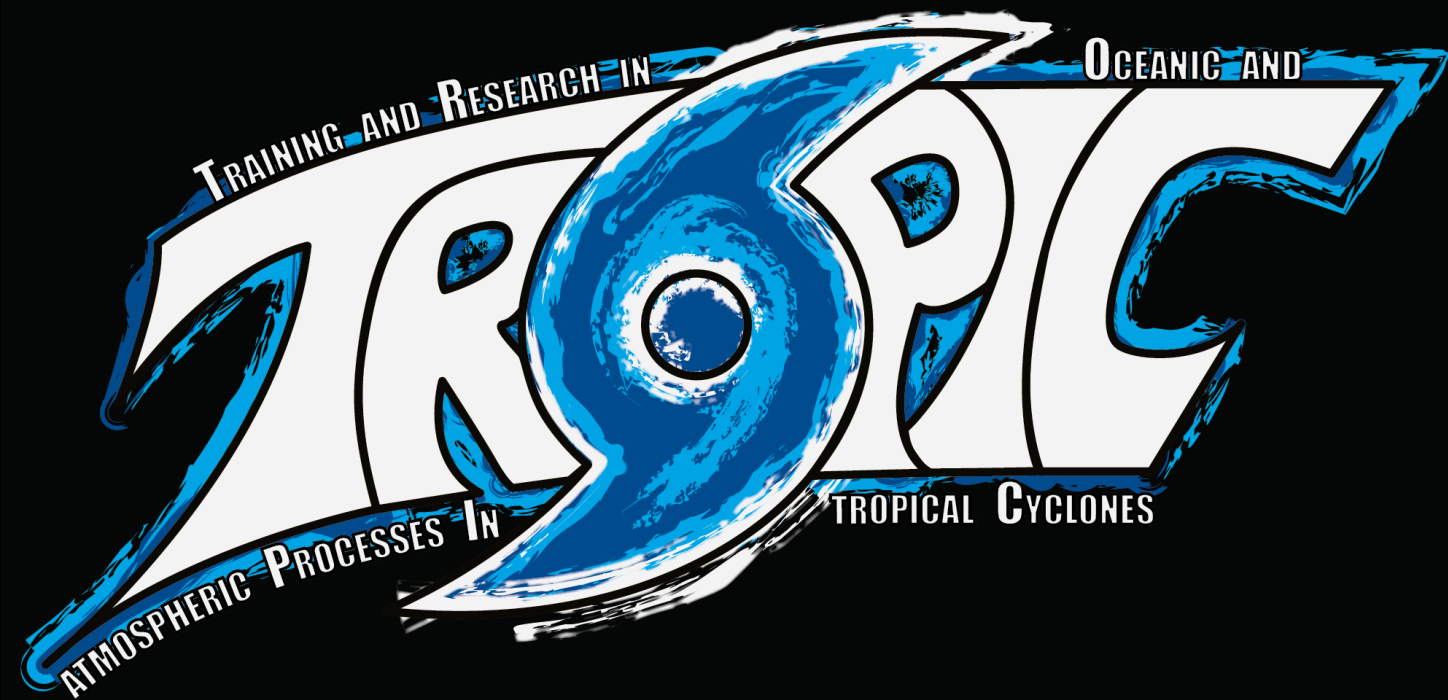
- **Equipment**
  - Re-design of AXBT launcher
  - Availability of modified launchers
- **Data & Data Path**
  - Standardize Quality Control
  - Standardize Archive Procedures
  - Resolution
    - AXBT JJVV vs. high-res temp profile data
    - Impact of decimation
  - Timing
    - NAVO: Real-Time Data Handling System
      - 2-hr binning
      - “black hole”
    - COAMPS: scheduling model runs
  - Assimilation
    - Analysis will reject profiles if the sample:
      - does not reach at least 300m or
      - half the water column depth
- **Sampling strategy**
  - Model sensitivity to observation position
  - Real-time tracking of ocean features and aircraft position



# 5-yr Outlook

Year	Duration	Data Collection Focus	Modeling Focus
2011	1 month (Jul-Aug)	Launcher, QC, Timing	Data Path (time), Assimilation
2012	2 months (Aug-Sep)	QC, Drop Patterns	Assimilation in near-real-time
2013	2 months (Aug-Sep)	QC, Drop Patterns, Automation	Assimilation in near-real-time
2014	2 months (Aug-Sep)	Automation	Real-time runs
2015	2 months (Aug-Sep)	Transition	Real-time runs





QUESTIONS?

29 NOV 2011

# TROPIC 2011 Field Phase

## July-August 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	JUL 25 Dep: USNA Arr: Keesler Equip setup	26 NAS Pensacola	27 Equipment training	28 <b>Flight 1 TS DON</b>	29 <b>Flight 2 TS DON</b>	30 Prep / load for St Croix
31-TRANSIT Dep Keesler Arr: St Croix Equip setup	AUG 01 <b>Flight 3 pre-EMILY</b>	02 -OFF-	03 <b>Flight 4 TS EMILY</b>	04 <b>Flight 5 TS EMILY</b>	05 TRANSIT Dep St Croix Arr: Keesler Equip setup	06 -OFF-
07 Flight Cancelled	08 SOP Development-1	09 SOP Development-2	10 <b>Flight 6 Training</b>	11 <b>Flight 7 Training</b>	12 Prep / load for St Croix	13 -TRANSIT Dep Keesler Arr: St Croix Equip setup
14 -OFF-	15 Flight Cancelled	16 - Flight Cancelled Prep gear to redeploy	17 Mids→USNA <b>Flight 8 Pre-HARVEY</b>	18	19 <b>Flight 9 Transit</b>	20
21	22 USNA Classes Begin	23	24	25	26 Mids→Keesler <b>Flight 10 IRENE</b>	27 Txt-Savannah <b>Flight 11 IRENE</b>
28 Mids→CHAR <b>Flight 12 IRENE</b>	29 Dep: Charlotte Arr: USNA	Midshipmen forward deployed w/ 53 <sup>rd</sup> WRS in: <div style="display: inline-block; width: 15px; height: 15px; background-color: #add8e6; border: 1px solid black; margin-right: 5px;"></div> St Croix <div style="display: inline-block; width: 15px; height: 15px; background-color: #90ee90; border: 1px solid black; margin-right: 5px;"></div> Savannah, GA				

# Background

- Preliminary results from the ABXT demonstration project in support of hurricane coupled modeling products and improvement in guidance to NHC hurricane specialists
- Peter Black, Naval Research Lab and SAIC, Inc.; and Elizabeth Sanabia, US Naval Academy
- *Summary: The first year of the hurricane ABXT demo project mandated at the 65<sup>th</sup> Interdepartmental Hurricane Conference Working Group for Hurricanes and Winter Storms has been completed. A total of 107 ABXTs were deployed and transmitted in near-time from WC-130J aircraft on 12 flights in 4 storms, including Hurricane Irene where 40 ABXTs were deployed. A total of 85 ABXTs passed the quality control tests and were ingested into the Stennis ocean model and the coupled COAMPS-TS model. A preliminary description of the strategies employed and use of data in two coupled modeling centers will be described.*